Technology for Alaskan Transportation

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In This Issue

Fixing Cracked Roads with Plastic

Have you ever noticed cracks in the roads of interior Alaska? The ones that run the same direction as the centerline? These cracks seem to get bigger by the day and are repaired all too infrequently. These cracks give small car and motorhome drivers heartburn. This problem can be virtually eliminated by using a geosynthetic material just below the pavement surface.

The newly coined term "geosynthetic" refers to any artificial material used to reinforce earth structures. Although we are in the infancy of discovering the behavior of geosynthetics in the real world, many experts believe that using geosynthetics within soil structures will become as common as using steel to reinforce concrete.

Following the introduction of geosynthetics in the early 1970s, their use has increased rapidly. Many new materials were introduced into the marketplace. Most of these geosynthetics were plastics—primarily mesh and fabric made from polypropylenes, polyethylenes and polyesters. Names such as geomembranes, geogrids, geodrains and geomats are now familiar to most engineers. Today, more than 50 manufacturers market hundreds of different geosynthetics in the United States.

While the uses of geosynthetics are limited only by the imagination of the engineer or contractor, the actual behavior of geosynthetics in Alaskan conditions has only been studied recently. Dr. Tom Kinney (from the Institute of Northern Engineering at the University of Alaska Fairbanks) has pioneered such studies. With the assistance of graduate student Bonnie Savage, Kinney

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Solving Traffic Congestion

While traffic congestion has long been a problem of the large American city, congestion is a growing problem in small cities as well. How many of us have heard residents refer to their city as the "unsynchronized light capital of the world?" Any community—regardless of size—can suffer from traffic congestion.

What can be done? In many cases, what works in small cities is the same thing that works in large cities, applied on a smaller scale. In general, tremendous benefits can be achieved simply through the proper application of fundamental traffic engineering principles. Traffic engineering improvements can often increase capacity as much as 15 to 20 percent and improve safety. Providing additional capacity on arterial streets and at intersections, or improved coordination of signal timing can often be the difference between a transportation system that

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Fixing Cracked Roads
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performed a series of full-scale tests to see if geotextiles can solve Alaskan problems. The Alaska Department of Transportation and Public Facilities has used the results of this research to design the reconstruction of the southern 30 miles of the Tok cutoff.

Kinney's team discovered several reasons for the problem of longitudinal cracking, such as shoulder settlement caused by thawing permafrost and shoulder instability due to soft soils. Regardless of the mechanisms, the result is the same. The road embankment splits apart, pulling the surfacing apart with it. Kinney discovered that properly designed geogrid will hold the pavement while the road embankment below continues to crack.

This conclusion is based upon tests of three road embankment sections 24 feet wide and 8 feet long. Half of each section was constructed on a wooden platform so that the road could be pulled apart at the centerline—much as Mother Nature pulls apart actual roads. Using a geosynthetic (Signode/ITW TNX 5001), Dr. Kinney found that the surface underwent very little distress when there was a 12 inch gap under the geogrid. Much to the researchers' surprise, the road was still easily and safely passable by cars and fully loaded trucks when the crack under the geogrid was increased to 3 feet in width. Without the geogrid, a 2 inch crack in a road surface is very inconvenient to most vehicles, and a 4 inch crack is dangerous.

Kinney's field tests indicate that the geogrid should be placed between 12 and 18 inches below the road surface. Laboratory tests are under way to further define the optimum designs for Alaska.

Research was funded by High Performance Plastics (a division of ITW Enterprises) and the Research Section of the Alaska Department of Transportation and Public Facilities. Results of the study will be published by DOT&PF sometime this spring. AT

News & Views

Microcomputer Users' Group

"TIME" is a users' group consisting of public transportation professionals interested in exchanging experiences, ideas and software. Membership is open to the public at no charge and includes a subscription to a newsletter called "TIME CAPSULE." To join, write the TIME Support Center, Department of Civil Engineering, Rensselaer Polytechnic Institute, Troy, NY 12180-3590.

Does Research Return a Profit?

Public confidence in science and technology is rooted in a belief that the innovations brought about through research help the economy. But what do economic studies show?

Numerous economists in recent years have attempted to measure R&D's impact on the nation's economy. Major studies performed to date confirm that research has a positive effect on economic welfare by fostering innovations, which in turn improve industrial productivity. According to a review of these studies by the American Association for the Advancement of Science, economists came to four major conclusions.

1. Advances in knowledge have been the biggest single factor in economic growth and productivity gains in the United States over the past four decades.
2. The rate of return on investments in R&D is generally high—both the private rate of return and the public or social rate of return. (Private rate of return is a measure of net profitability of an innovation to the innovator. Public rate of return includes also the economic benefits to users and others in the economy.)
3. High-technology, R&D-intensive industries have made an especially strong contribution to the economy.
4. Government-supported R&D has had a significant economic impact, although this cannot be quantified as clearly by the economic measures now generally used. (Increases in the government's productivity are not reflected in standard GNP and growth accounting indicators because the output of government services is not measured in terms of profit.)

Pothole Repair Guide

The Engineer's Pothole Repair Guide provides a practical primer in the cost-effective repair of potholes. The authors point out that expedient techniques for pothole patching are little more than exercises in futility. Nevertheless, proponents of such expedient procedures claim that more permanent repairs are not cost effective, because maintenance personnel must spend too much time preparing the hole, compacting the mix and such. In terms of dollars spent, this logic simply does not hold up. If a pothole is not permanently patched the first time, subsequent trips must be made to refill the hole. Each time the same pothole is patched, its expense to the agency increases.

A study by the Pennsylvania Department of Transportation in 1976 showed that repeated pothole patching cost five times as much annually as a one-time permanent patch. In addition, a value engineering analysis from the Aberdeen Proving Ground in Maryland showed that permanent repair would save an estimated 70 percent of their current budget for temporary road repair. Clearly, savings can be realized by correctly repairing potholes the first time, and this effort must be made by highway administrators and engineers.

Specific repair procedures are included in an insert to this newsletter entitled "Pothole Repair" (Planning, Design and Field Notes, Number 5). This information was adapted from *The Engineer's Pothole Repair Guide* by R.A. Eaton, Edmond A. Wright and William E. Mongeon. The handbook was published in 1984 by the U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory. Reprints of this guide can be obtained from the Transportation Technology Transfer Program in Fairbanks. Call (907) 474-7733.

Pavement Markings

Did you know that pavement markings (such as center lines, lane lines, edge lines and pedestrian crosswalks) can be the most cost-effective traffic control devices available to the traffic engineer? Drivers seem to pay more attention to markings than to signs and other devices.

Just for Grins

While accident reports can provide a valuable tool for finding problem areas, they sometimes are more humorous than helpful. The following statements come from actual insurance forms where the drivers tried to summarize the details of their accidents.

- Coming home I drove into the wrong house and collided with a tree I don't have.
- As I approached the intersection, a sign suddenly appeared in a place where a sign has never appeared before. I was unable to stop in time to avoid the accident.
- I collided with a stationary truck coming the other way.
- The guy was all over the road; I had to swerve a number of times before I hit him.
- A pedestrian hit me and went under my car.
- I had been driving over 40 years when I fell asleep at the wheel and had an accident.
- The indirect cause of the accident was a little guy in a small car with a big mouth.
- The telephone pole was approaching. I was attempting to swerve out of its way when it struck my front end.
- In my attempt to kill a fly, I drove into a telephone pole.
- The pedestrian had no idea which direction to run, so I ran over him.
- I saw a slow-moving, sad-faced, old gentleman as he bounced off the hood of my car.
- I was thrown from my car as it left the road. I was later found in a ditch by some stray dogs.
- I was on my way to the doctor with rear-end trouble when my universal joint gave way causing me to have an accident.

Traffic Congestion

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moves traffic poorly and one that moves it efficiently. Strategies include: (1) street widening, (2) intersection widening, (3) traffic signal improvements, (4) traffic channelization, (5) grade separation structures, (6) railroad grade crossing separations, (7) pedestrian improvements, (8) parking modifications, (9) improved traffic control devices, and (10) lighting improvements.

Since traffic signal systems have such a large influence on the quality of traffic flow in small to medium-sized cities, it is worth discussing ways to improve the efficiency of their operation. In addition, it is important to pay increased attention to available traffic analysis tools that can help evaluate the effectiveness of proposed transportation improvements.

The efficiency of traffic signal timing is often a major factor in influencing the quality of traffic flow in small to medium-sized cities. Despite this, maintenance of good signal timing is often not a priority of local governments. Scarce staff resources are most often devoted to responding to citizen requests. As long as the signals continue to turn from red to green to yellow, little public pressure is exerted to improve signal timing, perhaps due to complacency or lack of public awareness that things could work much better. In recognition of this, a number of states are now sponsoring some form of statewide signal timing improvement program.

A good example is California's Fuel Efficient Traffic Signal Management (FETSIM) Program, which provides California cities and counties with both the financial resources and technical assistance needed to optimally time their traffic signals. Grants are made to participating cities and counties which can use the money to pay for all aspects of projects to optimize signal timing: data collection, data processing, development and implementation of a timing plan, and field evaluation. Grantees have the option of using the money to pay in-house staff salaries or to contract with consultants or both. Training and technical assistance are also provided as part of the program to enhance the capabilities of the traffic engineers in these cities and counties to

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About Our Newsletter

Technology for Alaskan Transportation is a quarterly newsletter that informs local transportation people in government and industry of useful publications and services. The newsletter reports on useful research findings, new technology, and learning opportunities such as workshops, seminars and video tapes. To get on our mailing list or to contribute to the newsletter, contact:

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About Our Program

The goal of the Transportation Technology Transfer Program is to help local agencies obtain useful information and training related to local transportation needs. The program focuses on technology related to roads, bridges and public transportation. In addition to our newsletter, we will provide low-cost seminars and workshops, provide copies of useful technical reports upon request, and answer phone and mail inquiries related to transportation technology. If we don't have the answer, we will refer the question to a suitable specialist.

A variety of organizations support the Transportation Technology Transfer Program:

- ☐ the University of Alaska Transportation Center (UATC is an interdisciplinary center with participation from the schools of Engineering, Mineral Engineering, Management, and Agriculture and Land Resources Management).
- ☐ the Alaska Department of Transportation and Public Facilities
- ☐ the Federal Highway Administration

We invite you to address your questions or comments to any of the following people:

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Calendar of Events

We will be happy to include any relevant event you would like to publicize. Call the editor at (907) 474-6116. For information about events in Alaska, call John D. Martin at (907) 451-5150 or Dr. Jan Botha at (907) 474-7497.

1988

March 4—UATC's 1988 Alaska Transportation Forum. Fairbanks.

March 5—Transportation 2020 Forum. Fairbanks

March 11-13—Annual Meeting of the Alaska Society of Professional Engineers. Fairbanks. Call Larry or Joan at (907) 474-6121.

March 14-18—Traffic Signal Operation in Coordinated Systems Workshop. Atlanta, GA. Write Education Extension Services, Georgia Institute of Technology, Atlanta, GA 30332-0385.

March 21-25—Course on law and engineering. International Right of Way Association. Fairbanks. Contact Paul Costello at (907) 457-7033.

June 1-5—2nd International Conference on Case Histories in Geotechnical Engineering. St. Louis, MO. Contact Angelia Arrington at (202) 334-2934.

June 8-9—1st International Symposium on Surface Characteristics. State College, PA. Contact Angelia Arrington at (202) 334-2934.

Traffic Congestion

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continue to manage their signals effectively.

Based on simulation model runs, the retimed signal systems in the program's first three years attained average first year reductions of 16 percent in stops and 15 percent in delays. Travel times through the system declined an average of about 7 percent, and fuel use dropped by 8.5 percent.

The general magnitude of these results was confirmed by field studies in several of the participating cities. A total of 61 cities participated in the first three funding cycles, and a total of 3,172 signals were retimed. Assuming that the benefits will last for three years after their completion, a total of $72.3 million in fuel cost, plus $67.7 million in travel time and $91.6 million in vehicle wear and tear will be saved. Compared to a total cost of $4 million, the benefit-cost ratio is almost 60 to 1! Perhaps one of the most important things we Alaskans can learn from the California experience is the need to develop explicit strategies at the local level to deal with long-term maintenance of good signal timing.

This article was adapted from a small portion of a paper entitled "Managing transportation in smaller metro areas," which was presented by Dennis Judycki (Director, Office of Traffic Operations, Federal Highway Administration) at the International Public Works Congress and Equipment Show in Chicago. Copies of this 14-page paper are available from the Transportation Technology Transfer Program in Fairbanks. Call (907) 474-7733. AT

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